

Amendments to the Drawings:

The attached sheet(s) of drawings includes changes to Fig. 1b, 6c, and 9. This sheet, which includes Figs. 1-9, replaces the original sheet(s) including Figs. 1b, 6c, and 9.

Attachment: Replacement Sheets

Remarks

Claims 1-39 are pending in the present application. Claim 1-35 and 39 are rejected. Claims 36-38 are withdrawn from consideration.

Claims 10 and 32 are cancelled.

Claims 1 and 30 are amended to include the following limitation of claim -
“wherein the lean NOx trap is optimized for NH₃ generation by removing oxygen storage capacity of the lean NOx trap.”

Claims 2 and 3 are amended to explain “that a top layer comprising the lean NOx trap positioned over a bottom layer comprises the NH₃-SCR catalyst is repeated one or more times.”

Claims 4, 8, and 25 are amended to explain that “such that an upstream zone comprising the lean NOx trap positioned upstream of a downstream zone comprising the NH₃-SCR catalyst is repeated one or more times.”

Claims 18 and 24 are amended to insert “the” after “and”.

Numbered paragraphs [15], [20], [21], [22], [23] and [46] are amended to replace “Figure 4” with “Figures 4a, 4b, and 4c”, “Figure 5” with “Figures 5a, 5b, and 5c”, “Figure 6” with “Figures 6a, 6b, and 6c”, and “Figure 7” with “Figures 7a, 7b, and 7c.” Related verbs are corrected from singular to plural form when necessary.

Drawing 1b is amended to include a legend stating “Prior Art.” Figure 6c is labeled. Figure 9 is amended to indicate item 10.

1. Figure Objections

Figure 1b is objected to for lacking a legend identifying the figure as "Prior Art." Figure 1B is amended to include such a legend.

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: "10" (page 17, line 4). Figure 9 is amended to indicate item 10.

2. Disclosure Objections

The Examiner's objections regarding the Specification are addressed by amending numbered paragraphs [15], [20], [21], [22], [23] and [46] to replace "Figure 4" with "Figures 4a, 4b, and 4c", "Figure 5" with "Figures 5a, 5b, and 5c", "Figure 6" with "Figures 6a, 6b, and 6c", and "Figure 7" with "Figures 7a, 7b, and 7c." Related verbs are corrected from singular to plural form when necessary.

3. Claim Objections

Claims 18 and 24 are objected to because of minor informalities.

Claims 18 and 24 are amended to insert "the" after "and".

4. Rejections Under 35 U.S.C. 112

Claims 2-10, 25, 31-32, 39 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as the invention.

The Examiner's rejection under 35 U.S.C. 112 is addressed as follows. Claims 2 and 3 are amended to explain "that a top layer comprising the lean NOx trap positioned over a bottom layer comprises the NH₃-SCR catalyst is repeated one or more times." This amendment makes it clear that the one or more alternating layers means that taken as a whole the structure of a lean NOx trap layer and a NH₃-SCR catalyst layer is repeated. Clearly, this then creates an alternating layer configuration. Similarly, claims 4, 8, and 25 are amended to explain that "such that an upstream zone comprising the lean NOx trap positioned upstream of a downstream zone comprising the NH₃-SCR catalyst is repeated one or more times." This amendment makes it clear that the one or more alternating zones means that taken as a whole the structure of a lean NOx trap zone and a NH₃-SCR catalyst zone is repeated one or more times. Clearly, this then creates an alternating zone configuration.

Regarding claims 9, 10, 31-32, and 39 the Examiner states that it is unclear as to what structural limitation applicants are attempting to recite. Claims 9 and 31 include a limitation that "the lean NOx trap generates a sufficient quantity of NH₃ to force the reaction between NOx and NH₃, whereby NH₃ emissions are eliminated and net NOx conversion improved." This limitation limits the components and the component concentrations chosen for the NOx trap in that each of these variables must be chosen to encourage the reaction between NOx and NH₃. The term "force" in the context of chemical reactions is generally taken to mean to push the equilibrium towards the products or to enhance the reaction forming the products. Similarly, claims 10 (now incorporated in claim 1), 32 (now incorporated in claim 30) and 39 include a limitation that "the lean NOx trap is optimized for NH₃ generation by removing oxygen storage capacity of the lean NOx trap." The meaning of this limitation is obvious - the lean NOx trap is constructed to have fewer sites available for oxygen storage. Clearly, this is a structural limitation.

Accordingly, claims 2-10, 25, 31-32, 39 are allowable under 35 U.S.C. 112, second paragraph.

5. Rejections Under 35 U.S.C. §102(b)

Claims 1, 9-10, 12, 15-17, 19, 30-31 and 34 are rejected under 35 U.S.C. §102(b) as being anticipated Kinugasa et al. (EP 773,354).

Applicants respectfully traverse the Examiner's rejection for the following reasons. The Examiner incorrectly states that Kinugasa et al. discloses a lean NOx trap upstream of a NH₃-SCR. In fact, Kinugasa does not disclose such a configuration. Instead, Kinugasa discloses a three-way catalyst upstream of a NH₃-AO catalyst. A three-way catalyst is not a lean NOx trap. It is well known that three-way catalysts are different than NOx traps.

As explained in the Specification, "[t]he lean NOx trap functions by adsorbing NOx when the engine is running under lean conditions--until the NOx trap reaches the effective storage limit--followed by NOx reduction when the engine is running under rich conditions." A three-way catalyst does not effectively reduce nitrogen oxides in a lean environment. The differences between lean NOx traps and three-way catalysts are accurately summarized in U.S. Patent No.6,276,132 which states:

It is well known that a three-way catalyst was used to oxidize carbon monoxide (CO) and hydrocarbons (HC) and to reduce nitrogen oxides (NOx) contained in exhaust gas discharged from an internal combustion engine of an automotive vehicle or the like. The **three-way catalyst can effectively function in a stoichiometric atmosphere** (exhaust gas having a stoichiometric air-fuel ratio). However, **such three-way catalyst cannot function to reduce nitrogen oxides in a lean atmosphere** (exhaust gas having a leaner air-fuel ratio than the stoichiometric level). In this regard, a technique for reducing nitrogen oxides in the lean atmosphere has been made in Japanese Patent No. 2600492, which a **NOx trap agent can trap NOx in the lean atmosphere** and can release NOx by enriching air-fuel ratio of exhaust gas flowing to the NOx trap agent so as to reduce the released NOx.

U.S. Patent No.6,276,132, col. 1 , ll. 13-28

The increased efficiency of the present invention as described in independent claim 1 relies on the properties of inherent to a lean NOx trap which are different than the properties of a three-way catalyst. Specifically, the operation of the present invention requires that the ammonia bursts from the lean NOx trap be absorbed by the NH₃--SCR catalyst:

The NH₃--SCR catalyst system serves to **adsorb the ammonia emissions from the upstream lean NOx adsorber catalyst generated during the rich pulses**. Accordingly, as shown in FIG. 2, the ammonia emissions produced by the lean NOx adsorber is stored and effectively controlled by the NH₃--SCR catalyst rather than being emitted. This reservoir of adsorbed ammonia then reacts directly with the NOx emitted from the upstream lean NOx adsorber. As a result, as shown in FIG. 3, the overall net NOx conversion is enhanced from 55% to 80%, while depleting the stored ammonia, as a function of the SCR reaction: $\text{NH}_3 + \text{NOx} \rightarrow \text{N}_2$. The NH₃--SCR catalyst is then replenished with ammonia by subsequent rich pulses over the lean NOx adsorber.

The generation of such ammonia bursts from the lean NOx trap is inherently related to the lean trapping ability of these traps which is not characteristic of three-way catalysts. Independent claims 1 and 30 require a configuration with a lean NOx trap upstream of a NH₃--SCR catalyst.

Notwithstanding the arguments set forth above, independent claims 1 and 30 are amended to include the following limitation of claim 10 -- "wherein the lean NOx trap is optimized for NH₃ generation by removing oxygen storage capacity of the lean NOx trap." The Examiner's statement concerning claim 10 are confusing. However, the Examiner concedes that Kinugasa does not mention the oxygen storage capacity. Therefore, Kinugasa cannot and does not disclose removing the oxygen storage capacity making a rejection under 35 U.S.C. 102 of amended claims 1 and 30 inappropriate.

Accordingly, independent claims 1, and 30 along with dependent claims 9-10, 12, 15-17, 19, 31 and 34 are allowable under 35 U.S.C. §102(b) over Kinugasa et al.

Claims 1, 9-12, 14-17, 19, 30-31 and 34 are rejected under 35 U.S.C. §102(b) as being anticipated Kinugasa et al. (U.S. Patent No. 6,109,024).

For similar reasons as set forth above, Kinugasa et al. (U.S. Patent No. 6,109,024) does not mention the oxygen storage capacity. Therefore, Kinugasa cannot and does not disclose removing the oxygen storage capacity making a rejection under 35 U.S.C. 102 of amended claims 1, and 30 inappropriate.

Accordingly, independent claims 1 and 30 along with dependent claims 9-12, 14-17, 19, 31 and 34 are rejected under 35 U.S.C. §102(b) as being anticipated Kinugasa et al. (U.S. Patent No. 6,109,024).

6. Rejections Under 35 U.S.C. §103(a)

Claims 2-8, 18, and 20-29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kinugasa et al. (either U.S. Patent No. 6,109,024 or EP 773,354) in view of Fuwa et al. (U.S. Patent No. 6,345,496).

Independent claim 1 is amended to include the limitation of claim 10 which is shown above to be allowable. Therefore, for at least this reason claims 2-8 and 18 are allowable.

Notwithstanding this argument, claims 2-8, 18, and 20-29 are allowable for the following reasons. In support of the rejection, the Examiner states:

The apparatus of Kinugasa et al is substantially the same as that of the instant claims, but is silent as to whether the NO_x trap and the NH₃-SCR catalyst may be alternating layers/zones in a single shell or substrate.

However, Fuwa et al discloses the conventionality of providing a control system in which the NO_x trap and the NH₃-SCR catalyst are alternating layers/zones in a single

shell/substrate or mixed to form a single layer on one substrate (col. 25, line 50 to col. 6, line 7; col. 27, lines 13-23; col. 30, line 45 to col. 31, line 6).

Office Action dated September 9, 2005

A review of the cited passages from Fuwa et al. reveals that such an alternating layer or zone structure is **not** disclosed:

This engine also performs the lean and the rich engine operations alternately and repeatedly, to thereby make the exhaust gas air-fuel ratio of the exhaust gas flowing into the catalysts 8a and 10a lean and rich alternately and repeatedly, as shown in FIG. 5. Namely, the engine performs the rich operation to make the exhaust gas air-fuel ratio of the exhaust gas flowing into the catalysts 8a and 10a rich, to thereby synthesize NH_3 and adsorb NH_3 in the NH_3 -AO catalyst 10a, and performs the lean operation to make the exhaust gas air-fuel ratio of the exhaust gas flowing into the catalysts 8a and 10a lean, to thereby desorb NH_3 and reduce NO_x by the desorbed NH_3 on the NH_3 -AO catalyst 10a.

Fuwa, col. 25, ll. 9-20.

Instead, the it the conditions of the exhaust being lean or rich that is alternated by the engine (as is typically done nowadays). This is not a structural limitation on the catalyst system. Therefore, neither Kinugasa nor Fuwa et al. whether considered alone or in combination discloses an alternative layer or zone structure. Accordingly, claims 2-8, 18, and 20-29 are allowable under 35 U.S.C. 103(a) over Kinugasa et al. in view of Fuwa et al.

Claims 13 and 35 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kinugasa et al. (either U.S. Patent No. 6,109,024 or EP 773,354) in view of Yamada et al. (U.S. Patent No. 6,221,804).

Claims 11, 14 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Kinugasa et al. (EP 773,354) in view of Kinugasa et al. (U.S. Patent No. 6,109,024) or Fuwa et al. (U.S. Patent No. 6,345,496).

Regarding these last 2 rejections, claims 11, 13, and 14 depend from independent claim 1 which is shown above to be allowable. Therefore, these claims are also allowable. Similarly, claims 33 and 35 depend from independent claim 30 which is shown above to be allowable. Therefore, these claims are also allowable.

Conclusion

Applicants have made a genuine effort to respond to each of the Examiner's rejections in advancing the prosecution of this case. Applicants believe that all formal and substantive requirements for patentability have been met and that this case is in condition for allowance, which action is respectfully requested. If a telephone or video conference would help expedite allowance or resolve any additional questions, such a conference is invited at the Examiner's convenience.

Enclosed is a check in the amount of \$450.00 for a two-month extension of time. Any additional fees or credits as a result of the filing of this paper can be charged to Ford Global Technologies, LLC's Deposit Account No. 06-1510 as authorized by the original transmittal letter in this case.

Respectfully submitted,

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Date: 2/9/06

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